Scientific Inquiry

4-1 The student will demonstrate an understanding of scientific inquiry, including the processes, skills, and mathematical thinking necessary to conduct a simple scientific investigation.

4-1.3 Summarize the characteristics of a simple scientific investigation that represent a fair test (including a question that identifies the problem, a prediction that indicates a possible outcome, a process that tests one manipulated variable at a time, and results that are communicated and explained).
Taxonomy Level: 2.4-B Understand Conceptual Knowledge

Previous/Future knowledge: In 1st grade (1-1.3), students carried out simple scientific investigations when given clear directions. In 2nd grade (2-1.1), students carried out simple scientific investigations to answer questions about familiar objects and events. In 3rd grade, students explained why similar investigations might produce different results (3-1.7) and generated questions such as "what if?" or "how?" about objects, organisms, and events in the environment and use those questions to conduct a simple scientific investigation (3-1.3). In 5th grade, students will identify independent (manipulated), dependent (responding), and controlled variables in an experiment (5-1.2) and will plan and conduct controlled scientific investigations, manipulating one variable at a time (5-1.3). In 7th grade (7-1.3), students will explain the reasons for testing one independent variable at a time in a controlled scientific investigation.

It is essential for students to know the characteristics of a simple scientific investigation that represent a fair test.

- A *fair test* is one in which only one factor is changed or tested in the experiment so that it can be determined whether or not that factor affected the results.
- *Variables* are factors that can affect the results of an experiment. Before an investigation begins, the variables that could affect the results must be identified. Then it should be determined which one variable to change or test and which conditions should be kept the same in the experiment.
  - A *manipulated variable* is the one factor that is changed or tested by the person doing the investigation.
  - A *responding variable* is the result of, or response to, the changing of the manipulated variable.

In a *simple scientific investigation* the following steps should be included:

- Identify a testable question (tests one variable) that can be investigated
- Do some simple research about the topic
- State a prediction that answers the question based on your research
- Design an experiment to test the prediction
  - List the materials needed to conduct the experiment
  - List the steps to be followed to set up a fair test
- Record and organize data (observations) in tables, graphs, or charts
- Study the data in the tables, graphs, or charts to figure out what the data means
- Explain the results (response to the manipulated variable)
- Compare the results to your prediction

It is not essential for students to identify a manipulated variable as the independent variable or recognize the responding variable as the dependent variable in an investigation.

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Assessment Guidelines:

The objective of this indicator is to *summarize* the characteristics of a simple scientific investigation that represent a fair test; therefore, the primary focus of assessment should be to give major points about the steps of a scientific investigation as listed in the indicator. However, appropriate assessments should also require students to *identify* individual parts of an investigation that make a fair test; *recognize* parts of a simple scientific investigation; *explain* why only one variable is manipulated in a fair test; *exemplify* investigations that represent a fair test; or *classify* or *identify* a variable as manipulated or controlled.